

(21) Application No 7940767  
(22) Date of filing 26 Nov 1979  
(43) Application published  
10 Jun 1981

(51) INT CL<sup>3</sup>  
B01F 13/02

(52) Domestic classification  
B1C 18A1 B1D B2C  
F2V J2B

(56) Documents cited  
GB 1519644  
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GB 1222052  
GB 930171  
GB 751289

(58) Field of search  
B1C  
F2V

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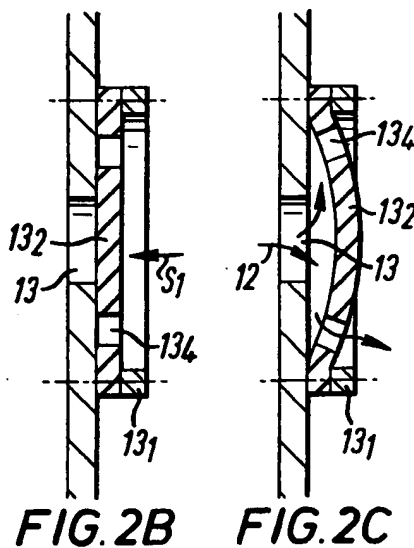
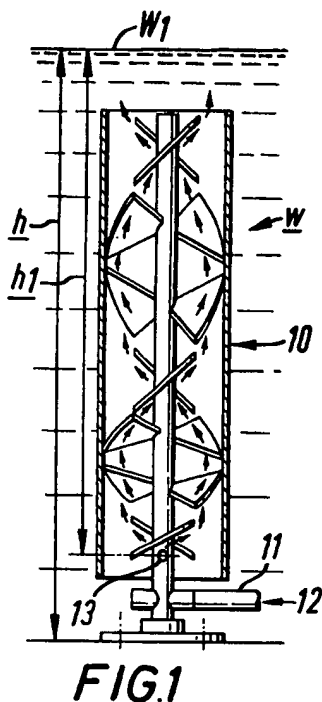
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(54) Improvements in circulating and  
gasifying apparatus partly or  
wholly submerged in a fluid

(57) A non-return valve 13A is fitted to  
an orifice 13 in an apparatus W to  
prevent blockage of said orifice during  
installation from a fluid flow in  
opposition to that experienced in use.  
The fluid flow is for example a flow of  
liquid with entrained foreign material as  
experienced in sludge treatment  
process.

102b  
1



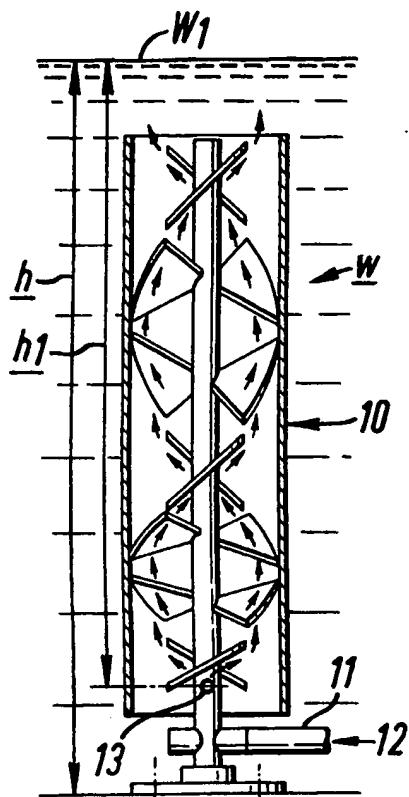


FIG. 1

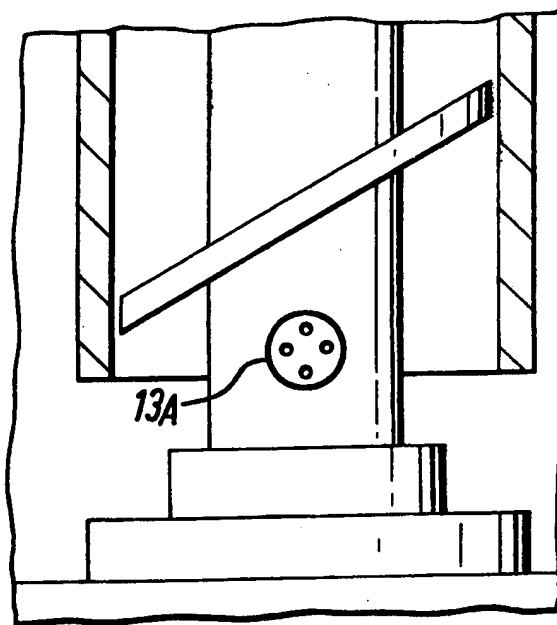


FIG. 1A

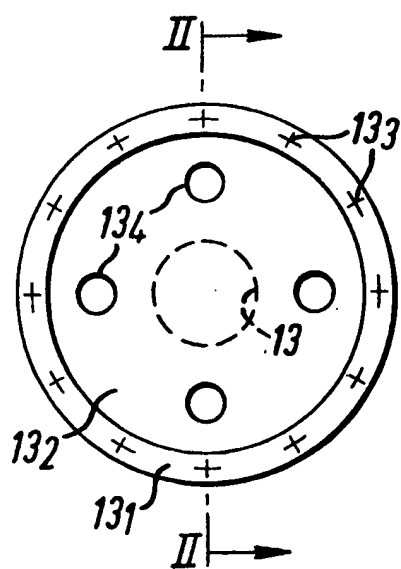


FIG. 2A

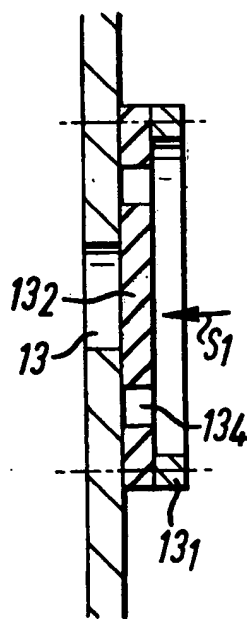


FIG. 2B

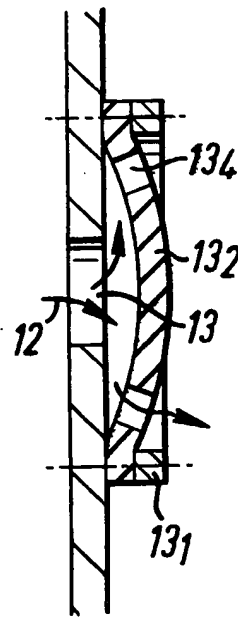


FIG. 2C

## SPECIFICATION

**Improvements in apparatus partly or wholly to be immersed in a fluid**

5 This invention relates to apparatus that in use is immersed partly or wholly in a fluid and thereby subjected to a pressure head. It is clear that any apparatus that is installed for example below the  
10 surface of a liquid will be subjected to a hydrostatic pressure head but it is generally lost sight of that a given depth will subject the apparatus to liquid flow through its orifices and apertures by virtue of said pressure head before it is connected for its correct  
15 operation in use, and that this liquid flow may be such as to block or otherwise cause malfunction of the apparatus before it is operational. We have found as one illustration of the drawback referred to above and possible danger therefrom that our apparatus  
20 described and claimed in United Kingdom Patent Specification 1,519,644 provided in use with an air bubble emitting orifice of 6 mm diameter for pressurized air was blocked by an article of clothing irrevocably forced into it by a pressure head generated by but a few feet of sludge water.

25 According to the present invention this drawback is overcome in apparatus that is to be installed in a fluid and thereby subjected to a pressure head during such installation and a fluid flow through an orifice therein in a direction opposite to that which it  
30 will enjoy in use by the provision of a non-return valve at said orifice.

The invention will be more fully understood from the following description given by way of example  
35 only with reference to the figures of the accompanying drawing in which:-

Figure 1 is a side elevation of an apparatus for circulating and gasifying a liquid and

40 Figure 1A is an enlargement of a part only of that apparatus as indicated.

Figures 2A, 2B and 2C show seriatim to a larger scale a front view of a non-return valve and two side elevations in diametral section on the section station  
45 II II of Figure 2A when the said valve is closed and the said valve is open.

Referring now to the Figures of the drawing apparatus for circulating and gasifying a liquid is shown generally at 10. Air enters by the pipe 11 as  
50 shown by arrow 12 and comes out in operational use of orifice 13. Let us now consider the installation of apparatus 10 at a fully immersed position below the surface W1 of sludge water w at a depth of  $h$  feet prior to the connection of air supply 12. Orifice 13 is  
55 subjected to a hydrostatic pressure head  $h_1$  and a flow of sludge water will take place in a direction in contradistinction to the direction of the air that in use will be emitted from it. Any foreign matter entrained in the flow of sludge water will enter orifice 13 and may block it since orifice 13 in one example is but 6  
60 mm in diameter. To prevent such a blocking of said orifice 13 we provide, as shown in Figure 1A, a non-return valve 13A drawn to a larger scale in Figures 2A, 2B and 2C.

Non-return valve 13A comprises an outer ring 13<sub>1</sub>,  
65 a diaphragm 13<sub>2</sub> and bolts 13<sub>3</sub> around the periphery

of the diaphragm 13<sub>2</sub> and ring 13<sub>1</sub>. The diaphragm 13<sub>2</sub> has a number of holes 13<sub>4</sub> outside of the open area 13<sub>5</sub> of the orifice 13.

The *modus operandi* is elementary yet efficacious;  
70 in Figure 2B at installation pressure head  $h_1$  generates a flow of sludge water indicated by arrow S1 and diaphragm 13<sub>2</sub> acts as an obturator and closes onto orifice 13, the holes 13<sub>4</sub> being blocked. After installation at depth  $h$  and air line 11 being supplied  
75 with air 12 diaphragm 13<sub>2</sub> opens (Figure 2C) to allow air to escape from orifice 13 via holes 13<sub>4</sub>. We prefer to make the diaphragm 13<sub>2</sub> of rubber and all other parts of non-metallic or non-corrosive materials since the valve has to operate for long periods without maintenance.

## CLAIMS

1. In apparatus that is to be installed in a fluid and thereby subjected to a pressure head during such installation and a fluid flow through an orifice  
85 therein in a direction opposite to that which it will enjoy in use, the provision of a non-return valve at said orifice.

2. Apparatus according to claim 1 wherein the non-return valve is a diaphragm that acts as an  
90 obturator to said orifice and is retained by a peripheral ring, said diaphragm containing one or more holes placed outside the area of said orifice.

3. Apparatus according to claim 1 or claim 2 wherein the non-return valve is made wholly of rubber.

4. Apparatus constructed and adapted to operate substantially as hereinbefore described and as  
95 shown in the figures of the accompanying drawing.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.,  
Berwick-upon-Tweed, 1981.  
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY,  
from which copies may be obtained.